DETAILED ACTION

This Office Action is in response to amendments and remarks filed November 4, 2009. Claims 1, 3-19 are currently pending.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 4, 6, 7 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Amako et al. (US 5589955).

Re claim 1: Amako teaches a laser processing apparatus (fig. 1 and 2) comprising: a laser source (101); a spatial phase modulator (104) configured to modulate a phase of a laser beam emitted from the laser source (col. 4, lines 43-46); a synthetic data generator (110, 109, and 108) configured to generate synthetic data by combining hologram image data representing a pattern image (110, 202, 203, 206, 208, 209, 212, and 213) (col. 5, lines 41-61, this is the image) to be processed with position displacement hologram data (210 and 211, col. 5, lines 61-62 and col. 6, lines 18-23) for shifting the pattern image to a prescribed position (col. 6, lines 18-23 and lines 27-32), said synthetic data being input to the spatial phase modulator for the phase modulation of the laser beams (from 214-108 in fig. 2, which controls the new image on the spatial light modulator 104 see fig. 1); and a focusing optical unit (105) configured to guide the

phase-modulated laser beam onto a surface to be processed to reproduce the pattern image on the processed surface (106) (col. 4, lines 49-50 and fig. 1), wherein the position displacement hologram data include either a horizontal hologram data set representing displacement in a direction parallel to the processed surface, a vertical hologram data set representing displacement in a direction perpendicular to the processed surface (the lens phase would adjust the image in a perpendicular direction to the processed surface because the focal length of the lens phase is being changed, when the focal length of the lens is changed the image being formed will be shifted in a perpendicular direction with the surface to be processed, col. 6, lines 27-29), or a combination of the horizontal and vertical hologram data sets.

Re claim 4: Amako teaches the laser processing apparatus, wherein the vertical hologram data set has a phase distribution profile similar to a Fresnel zone plate (col. 8, lines 30-41).

Re claim 6: Amako teaches the laser processing apparatus, further comprising: a wavefront measuring unit configured to measure a wavefront of the laser beam input to the spatial phase generator; wherein the synthetic data generator generates correction data for correcting distortion of the wavefront of the laser beam detected by the wavefront measuring Unit, and the correction data are supplied to the spatial phase modulator (col. 10, lines 32-48).

Re claim 7: Amako teaches the laser processing apparatus, further comprising at least one of: an irradiation time adjusting unit (107) configured to regulate irradiation

time of the laser beam (col. 7, lines 24-30); and a beam intensity adjusting unit configured to regulate an intensity of the laser beam (col. 10, lines 16-24).

Re claim 10: Amako teaches the laser processing apparatus, further comprising: a first driving unit (fig. 17) configured to move a light spot of the laser beam relative to the processed surface in a direction parallel to the processed surface (col. 13, ;lines 63-71 and col. 14, lines 1-31 and see fig. 17).

3. Claims 1, 12, 14, 15, 16, 17 and 19 are rejected under 35 U.S.C. 102(b) as being anticipated by Amako et al. (US 5497254).

4. Re claims 1, 14, and 16: Amako teaches a laser processing apparatus (fig. 1, 21, 24 and 30) comprising: a laser source (104); a spatial phase modulator (106) configured to modulate a phase of a laser beam emitted from the laser source (col. 3, lines 51-53); a synthetic data generator (101 and 102) configured to generate synthetic data by combining hologram image data representing a pattern image (col. 16, lines 27-31, the image) to be processed with position displacement hologram data (col. 16, lines 27-31, the Fresnel transformation, col. 13, lines 36-55) for shifting the pattern image to a prescribed position (col. 13, lines 36-55), said synthetic data being input to the spatial phase modulator for the phase modulation of the laser beams (see fig. 1 and 24); and a focusing optical unit (107) configured to guide the phase-modulated laser beam onto a surface to be processed to reproduce the pattern image on the processed surface (108), wherein the position displacement hologram data include either a horizontal hologram data set representing displacement in a direction parallel to the processed

surface (see fig. 19), a vertical hologram data set representing displacement in a direction perpendicular to the processed surface (see fig. 19 or 18), or a combination of the horizontal and vertical hologram data sets (see fig. 19) (fig. 19 uses the applied transformations to shift the image produced by the computer in both horizontal (X and Y directions, parallel) and vertical ((focal plane change, perpendicular) direction) (the Fresnel portion of the spatial modulator would adjust the focus so that the image is formed at a different perpendicular position to the surface being processed). The computer readable storage medium encoded with a computer readable program configured to cause an information processing apparatus to execute a method (col. 3, lines 56-67, the stored image is implemented into the computer memory (readable medium) where positional data is applied to the image for correction then the final product is sent to the spatial modulator through the PC). In response to applicant's arguments, the recitation “computer readable storage medium" has not been given patentable weight because the recitation occurs in the preamble. A preamble is generally not accorded any patentable weight where it merely recites the purpose of a process or the intended use of a structure, and where the body of the claim does not depend on the preamble for completeness but, instead, the process steps or structural limitations are able to stand alone. See *In re Hirao*, 535 F.2d 67, 190 USPQ 15 (CCPA 1976) and *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951).

Re claim 17: Amako teaches the laser processing apparatus, wherein the position displacement hologram data include either a horizontal hologram data set representing displacement in a direction parallel to the processed surface (see fig. 19),

a vertical hologram data set representing displacement in a direction perpendicular to the processed surface (see fig. 19 or 18), or a combination of the horizontal and vertical hologram data sets (see fig. 19) (fig. 19 uses the applied transformations to shift the image produced by the computer in both horizontal (X and Y directions, parallel) and vertical (focal plane change, perpendicular) direction).

Re claim 12: Amako teaches the laser processing apparatus, further comprising: a second driving unit (2409) configured to move a position of the processed surface relative to the focusing optical unit in a direction perpendicular to the processed surface (col. 16, lines 11-26).

Re claim 15: Amako teaches the laser processing method, further comprising the step of: setting a distance between a phase modulating position and the optical system equal to a focal length of the optical system (see fig. 16, 30, 31, and 33).

Re claim 19: Amako teaches the computer program product, wherein the computer executes the step of generating the vertical hologram data set having a phase distribution similar to a Fresnel zone plate (see fig. 19 or 18) (col. 16, lines 27-35).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 3 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Amako et al. (US 5497254) in view of Hamano et al. (US 20040179253).

Re claims 3 and 18: Amako teaches the laser processing apparatus, wherein the position displacement hologram data include either a horizontal hologram data set representing displacement in a direction parallel to the processed surface (see fig. 19 or 13), a vertical hologram data set representing displacement in a direction perpendicular to the processed surface (see fig. 19 or 18), or a combination of the horizontal and vertical hologram data sets (see fig. 19) (fig. 19 uses the applied transformations to shift the image produced by the computer in both horizontal (X and Y directions, parallel) and vertical (focal plane change, perpendicular) direction), wherein the position data comes from either a Fourier transformation or a Fresnel transformation (Fourier, col. 18, lines 43-51, Fresnel, col. 13, lines 19-32 and col. 16, lines 27-35). Amako does not specifically teach the horizontal hologram data set has substantially a saw-tooth phase distribution profile. One of ordinary skill would have used a saw tooth phase distribution for the Fourier transform/Fresnel transformation in order to produce a horizontal shift in the position of the image. As seen in Hamano, who teaches a computer generated hologram (fig. 3), wherein the positional translation of the image is formed by combining the image with a saw-tooth wave function (see fig. 3 and 4) (the hologram image is shifted horizontally, parallel to the processed surface). It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement a saw-tooth phase distribution as seen in Hamano with the hologram image and spatial modulator of Amako in order to provide the device with another way of translating the

image to provide for diverse imaging system that can use multiple functions to image three dimensional objects.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Amako et al. (US 5589955) herein after referred to as Amako ('955) in view of Amako et al. (US 5497254) herein after referred to as Amako ('254).

Re claim 5: Amako ('955) teaches the laser processing apparatus (fig. 1), wherein the spatial modulator (104) is placed next to the focusing optical unit (105). Amako ('955) does not specifically teach a distance between the spatial modulator and the focusing optical unit is equal to the focal length of the focusing optical unit. One of ordinary skill in the art would have placed the spatial modulator at the focal length of the focusing device in order to improve the quality of the final image to be processed or created. As seen in Amako ('254) who teaches different embodiments of a laser processing apparatus where the spatial light modulator is located and the focal length of the focusing unit (fig. 16, 30, 31, and 33). It would have been obvious to one of ordinary skill in the art at the time the invention was made to place the spatial light modulator of Amako ('955) a distance away from the focusing unit that is equal to the focusing unit's focal length in order to improve the quality of the final image to be processed.

8. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Amako et al. (US 5589955) in view of Yamada et al. (US 20030152756).

Re claim 13: Amako teaches the laser processing apparatus, further comprising at least one of: an irradiation time adjusting unit (107) configured to regulate irradiation time of the laser beam (col. 7, lines 24-30); and a beam intensity adjusting unit configured to regulate an intensity of the laser beam (col. 10, lines 16-24) and the device is used for shaping three dimensional surfaces (abstract). Amako does not specifically teach the laser processing apparatus, wherein the laser source is an ultra-short pulse laser source with a pulse width at or below several picoseconds. One of ordinary skill in the art would have known to use a certain pulse width for the laser dependent upon the use of the device. As taught in Yamada. Yamada teaches a process for processing a three dimensional structure (abstract), wherein the laser can have different pulse widths dependent upon material being formed (paragraph 222 and 223). It would have been obvious to one of ordinary skill in the art at the time the invention was made to pulse the laser at or below several picoseconds as in Yamada in order to have a laser process device of Amako that can produce a three dimensional object in a metal layer.

9. Claims 8, 9, and 11 rejected under 35 U.S.C. 103(a) as being unpatentable over Amako et al. (US 5589955) in view of Thompson, Jr. et al. (US 6717104).

Re claim 8: Amako teaches the laser processing apparatus, wherein the image (hologram data) is prepared using a measured surface value (col. 13, lines 46-55). Amako does not specifically teach the laser processing apparatus, further comprising: a horizontal-direction position detector configured to detect a horizontal position in a plane

parallel to the processed surface; wherein the synthetic data generator generates the horizontal hologram data set based on the detection result. However, since Amako teaches that depth translation is achieved when the focal length of the lens function superposed on the kinoform data is changed (col. 14, lines 37-46), one of ordinary skill would implement a surface distance measurement, and incorporate the new distance measurement by changing the lens phase function and superposing it to the hologram. As further evidenced by Thompson, who teaches a laser machining application (fig. 2), comprising a camera (25) to detect the image pattern on the processing surface (see fig. 2) then using the data to adjust the phase position of the hologram image (col. 5, lines 46-55). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the camera in Thompson to image the processing surface and use the data to adjust the hologram image in Amako and apply it to the spatial modulator to improve the improve upon the desired irradiance pattern providing for a more accurate machining operations.

Re claim 9: Amako as modified by Thompson teaches the laser processing apparatus, wherein the horizontal-direction position detector detects a reference pattern formed on the processed surface (Amako, col. 14, lines 37-46 and Thompson, col. 5, lines 46-55).

Re claim 11: Amako teaches the laser processing apparatus, wherein the image (hologram data) is prepared using a measured surface value (col. 13, lines 46-55). Amako does not specifically teach the laser processing apparatus, further comprising: a vertical-direction position detector configured to detect a positional relation between the

focusing optical unit and the processed surface in a direction perpendicular to the processed surface; wherein the synthetic data generator generates the vertical hologram data set based on the detection result. However, since Amako teaches that depth translation is achieved when the focal length of the lens function superposed on the kinoform data is changed (col. 14, lines 37-46), one of ordinary skill would implement a surface distance measurement, and incorporate the new distance measurement by changing the lens phase function and superposing it to the hologram. As further evidenced by Thompson, who teaches a laser machining application (fig. 2), comprising a camera (25) to detect the image pattern on the processing surface (see fig. 2) then using the data to adjust the phase position of the hologram image (col. 5, lines 46-55). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the camera in Thompson to image the processing surface and use the data to adjust the hologram image in Amako and apply it to the spatial modulator to improve the improve upon the desired irradiance pattern providing for a more accurate machining operations.

Response to Arguments

10. Applicant's arguments filed November 4, 2009 have been fully considered but they are not persuasive.

11. In regards to the Applicant's arguments that Amako et al. (US 5589955) does not teach the vertical or the horizontal hologram data set or the combination of the two for adjustment (Arguments, page 9, lines 16-25 and page 10, lines 1-3). Examiner

respectfully disagrees with Applicant. Examiner asserts that Amako ('955) teaches applying data, lens phase data, in order to shift an image in a spatial modulator in a perpendicular direction from the surface of the processing surface. In Amako ('955), see figure 20, this is to show the perpendicular movement. The image would be at the focal point and the lens would have to be moved to get a 3d image to form or form and image on a curved surface, with the system of Amako ('955) there would be no lens adjustment because the image would be corrected with a lens phase, which would adjust the focal length without moving any of the lenses in the system. The computer combines the lens phase with an image and implements it into the spatial modulator then the image is moved to a new focal point in the perpendicular direction in order to form a 3d image or scribe a pattern on a curved surface. This clearly shows a perpendicular movement of the image as the claim states, therefore this lens phase data can be a vertical position data since it has the same output as the vertical data in the claim. Based on the above argument the rejection of claims 1, 4-11, and 13. In regards Applicant's arguments that Amako et al. (US 5497254) does not teach the vertical or the horizontal hologram data set or the combination of the two for adjustment (Arguments, page 10, lines 4-22). Examiner respectfully disagrees with Applicant. Examiner asserts that Amako ('254) teaches combining an image data with a lens data in order to adjust the image in a horizontal and vertical direction, perpendicular and parallel to the processing surface respectively (see fig. 20 a and b) (col. 16, lines 27-31). The lens data is applied to the image information then the computer uses the information to adjust the spatial modulator in the vertical (perpendicular) direction, by

using a Fresnel lens, to adjust the focal point (in figure 18, the focal point changes dependent on the Fresnel data). The lens data is also used to adjust the image in the x and y direction, horizontal (parallel) to the processing surface (see fig. 19b and 20b, F2 and F1 are moved in the y direction parallel to the processing surface). Based on the above argument the rejection of claims 1, 3, 12, and 14-19. Both Amako references teach modulate the phase of the laser beam in order to move the beam itself so that is scribes images into a processing surface, moves the laser beam in a vertical as in Amako ('955) or both vertical and horizontal in Amako ('254) in order to create a 3d image in the processing surface or create an image in a curved processing surface.

12. As a note, there was a typo in the first office action the rejection of claim 4 under 35 U.S.C. 103(a) as being unpatentable over Amako et al. (US 5589955) herein after referred to as Amako (558') in view of Amako et al. (US 5497254) herein after referred to as Amako (549'), should have been a rejection of claim 5. The rejection was made of claim 5, but the number 4 was typed instead of 5. The rejection still stands since it is the same rejection.

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER BENNETT whose telephone number is (571)270-3419. The examiner can normally be reached on Monday - Friday 0730 - 1700 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on 571-272-2328. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. B./

/Georgia Y Epps/
Supervisory Patent Examiner, Art Unit 2878